COMPUTERS
AND
AUTOMATION

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Vol. 2, No. 9

How a Central Laboratory Computing Laboratory Can Help Industry

... Richard F. Clippinger

"Combined" Operations in a Life Insurance Company Instead of "Fractured" Operations

... R.T. Wiseman

"Can Machines Think?" -- Discussion

... J.L. Rogers, A.S. Householder

DECEMBER, 1953

A REPORT FROM THE LABORATORIES OF REMINGTON RAND ON

ELECTRONIC DEVELOPMENTS FOR BUSINESS AND SCIENCE

Much of the popular talk about "giant brains" has actually obscured the work which electronic computing systems *are doing now* . . . to answer the pressing problems of business record keeping and control as well as scientific and mathematical computations.

An electronic computer system can process a large volume of data faster and more economically than any other method. Only one operation is required for a complicated program of computing, selecting and filing information. Routine decisions can be made automatically on the basis of instructions given the system. Exceptional conditions requiring management attention can be automatically signaled.

Remington Rand presents here some practical electronic devices which may be applied profitably today by business and science:

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This Fac-tronic storage system is a new Remington Rand development. For John Plain & Co., a large wholesale mail order firm, it produces up-to-the-minute inventory analysis by item under the most demanding conditions of seasonal and shifting demand. Just ten order clerks—working at 10-key input systems to a magnetic drum memory—can provide accurate tallies of orders for 12,000 different items; make available complete tallies each day or anytime needed; and accommodate approximately 80,000 order lines per day.

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Remington Rand offers two distinct families of big computing systems: 1) The UNIVAC all-purpose system is designed primarily for business record keeping; 2) the ERA 1101, 1102 and 1103 general purpose systems are designed for scientific or mathematical computations.

Solving problems *today!*

Right now, electronic systems are working economically on such practical tasks as—billing and accounting, statistical reports and forecasts, planning studies and scheduling, production and inventory control, payroll and cost accounting records, pricing analyses, engineering design and many data-reduction applications.

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ERA systems have an enviable record for high-speed solutions to complicated mathematical problems such as data reduction, systems simulation, planning studies, and control in real time. The new ERA 1103 provides very high internal speed, large storage capacity, and flexibility to surpass other systems of the same character. The 1103 also provides versatility of input and output—by teletype tape, magnetic tape, punched cards (80 or 90 columns), line printer, electric typewriter, and oscilloscope.

Custom-made systems

Air traffic control is just one example of the many special purpose electronic computer systems created by Remington Rand. This high-speed system receives via teletype such flight facts as: departure time, destination, route, fuel load, payload, and other pertinent data. In less than half a second, the system electronically compares the facts on each flight with as many as 2,000 flight plans it has stored in its magnetic-drum memory. It then revises, cancels, or brings the information up to date according to current conditions. The system completes the process by teletyping the required results back to the sending station . . . without human handling.

System designing

Remington Rand specialists analyze *your* needs in scheduling, process control, machine control, inventory control, data reduction, automatic filing, or other problems. A system may be created for you from standardized "building block" components, or we can make components to meet your needs.

Computing services

Through two electronic-computing centers, Remington Rand offers you the advantages of the UNIVAC and the ERA systems on a service-bureau basis. The centers have solved problems of such diverse types as complex accounting and record keeping, involved statistical and personnel studies, and cross-indexing of complex catalogs, books, and timetables.

One of the recent jobs handled by the UNIVAC center was a study of seasonal sales patterns and advertising timing. The Bureau of Advertising wanted a projection of 1954 monthly buying trends for 28 specific lines of merchandise in stores across the nation. To do the calculations on this series of 336 trend lines with desk calculators would have taken about 200 man-hours. The UNIVAC computer made all the calculations in just 3 and ½ minutes.

Let us show you how to save time and money on one-time jobs, deadline jobs, unusual jobs, and even routine jobs.

Management seminars

Through seminars and training courses, Remington Rand will help you learn how to apply electronic methods to your needs. In this way your organization can determine for itself the computer system needed—and the economic considerations involved—including choice between our rental or purchase plans. Remington Rand will also train your employees to operate the system efficiently. For more information, write to Remington Rand Inc., Electronic Computer Dept., Room 1460, 315 Fourth Avenue, New York 10, New York.

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EMPLOYMENT OPPORTUNITIES

in the Field of Computers and Automation

Any organization looking for personnel is invited to send us information, on the basis of which entries will be constructed. Entries will also be constructed on the basis of other information.

Electronic Computer Division of Underwood Corp. 35-10 36th Ave, Long Island City 6, N. Y.:
Constructing general-purpose medium-size automatic digital computers; reported to be expanding.

Franklin Life Insurance Co., 812 South 6th St. Springfield, Ill.:
Recent purchaser of a Univac; might be interested in good programmers.

International Business Machines Corp., 590 Madison Ave., New York 22, N. Y., and elsewhere:
Intensive program of electronic computer development for business applications; has expanded from 39,000 to 42,000 persons employed in a year or two; undoubtedly has many openings.

Metropolitan Life Ins. Co., One Madison Ave., New York 10, N. Y.:
Is expected to acquire soon a large-scale automatic electronic digital computer of great capacity for commercial work; might be interested in good programmers.

New York University, Institute of Mathematical Sciences, Atomic Energy Commission Computing Facility, 253 Greene St., New York 3, N. Y.:
Recent purchaser of a Univac; might be interested in programmers, mathematicians, etc.; security classification.

Radio Corporation of America, RCA Victor Division, Camden, N. J.:
Computer design, development, construction, and applications in business; might be interested in electronic designers, programmers, etc.

Sandia Corporation, Sandia Base, Albuquerque, N. Mex.:
Reported to be a renter of an IBM Type 701; might be interested in programmers, mathematicians, etc.; security classification probably.

Note: We have heard that one programmer with good experience, mathematical background, and education, was recently hired at an annual salary in excess of $10,000.

THE EDITOR'S OFFICE

Location of Advertising. One of our readers, whose opinions we always value, has urged us repeatedly to arrange the advertising in COMPUTERS AND AUTOMATION here and there through the magazine. He insists that if our advertising is "reasonable, informative and worth reading", as we say it is, then it should be put here and there in order to be seen and read; and of course advertisers like their ads next to editorial matter. In fact, we have received advertisements that are not only interesting but very interesting, and on such occasions we have not cared for the departmental grouping of ads all together as in previous issues. Consequently, in this issue we have begun to arrange advertising both in the front and the back of the magazine, and to fill spaces at the end of editorial matter.

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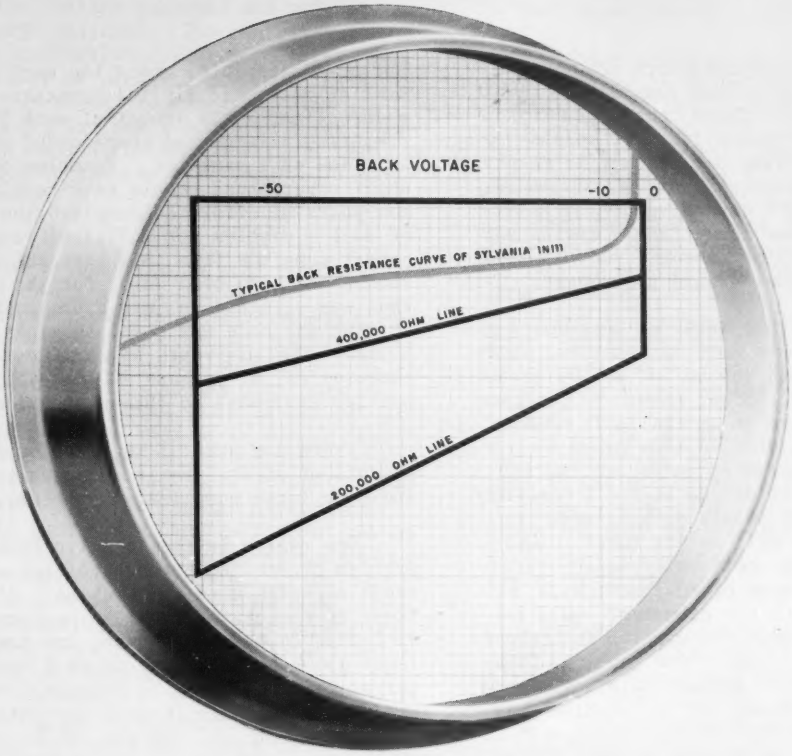
Address Changes. If your address changes, please notify us giving both old and new addresses, and allow three weeks for the change.

Back Copies. Issues October, 1952, to date are available. Price $1.25 each; or a subscription may be specified to begin with a stated issue. See more information on page 35.

Manuscripts: For manuscripts wanted, see the note on page 13.

Sylvania Computer Crystal Diodes



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HOW A CENTRAL COMPUTING LABORATORY CAN HELP INDUSTRY

Dr. Richard F. Clippinger, Head of Computing Services,
Raytheon Manufacturing Co., Waltham, Mass.

Automatic digital computers are now available commercially at prices ranging from $50,000 to about $1,000,000. These computers range in speed from about 10 operations per second to about 20,000 operations per second, in memory capacity from 100 numbers to 1,000,000 numbers, in number size from 5 decimal digits to 15 decimal digits, in input speed from 5 digits per second to 180 digits per second, and with 10,000 digits per second just around the corner.

Confronted by this array of possibilities, a person having one or more mathematical problems to solve may ask whether or not he should use such computers? If so, should he purchase a computer, rent time on an available computer, or turn his problem over to some group which specializes in programming and operating services? If he is considering buying a computer, what kind? How many people does he need to staff it, and where will he get them? What about training? How about maintenance, floor space, etc.? What kind of equipment will he need to go along with the computer? Will he need supplementary desk computation facilities? Data-reduction facilities? How shall he formulate his problem for computer solution? Should he use the same statement of the problem for computer solution as he did previously, or should he restate his problem in more general form? Does he have to prepare his problem differently depending on whether he wants to run it many times over a period of years, or whether he wants just a few answers? Should he carry out the program preparation himself? What numerical techniques should be used? How accurate will his answers be? How does he assure himself that his answers are right? What does he do if they are not? How much money will a computer save him?

These and many other questions which will confront him suggest the need and desirability of central commercial computing centers. Let us discuss some of the services which can be rendered by such a center.

Reduction of Costs

The principal function of a computing center is to reduce costs.

In the first place, a central laboratory reduces customer costs by using the same code for many customers. The disillusionment when a potential computer user discovers that machines do not think like human beings is severe, but never complete. Even the most experienced user of automatic digital computers sometimes underestimates the amount of work involved in preparing a large and complicated problem for solution on a computer. Examples can be cited where experienced people have required 5 to 10 man-years of effort to complete the preparation of such a problem for a digital computer. We cannot conclude from this that the problem should not have been done: for the information that was obtained in four hours on the computer when the code was complete might have required 1,000 man-years to carry out by hand computation, or perhaps 100 man-years and expensive equipment to obtain experimentally.

There are several reasons for the large amounts of effort required to analyze, program, and code large complicated problems.

One reason is the "Scaling Problem", the problem of scaling numbers to stay within the range acceptable to the machine. Millions of steps of computation must be performed without exceeding capacity or losing too many significant digits. In a case where a machine requires all numbers to be between 0 and 1, the first event may result from any addition or division (examples, .6+.5, .6/.5) and the second event may result from many multiplications involving small numbers.

Another reason is the "Convergence Problem". Most design problems are based on some mathematical process of converging to a limit. Frequently several different methods may have to be completely prepared and tried before one is found that works well.

A third reason is the need for tests. If the problem will run more than an hour and the machine is not self-checked electronically, it becomes imperative to program and code tests to determine the correctness of answers, and also to program and code procedures for rescuing the problem when an error is made. This is a large subject in itself.

I do not wish to give the impression that all problems are extremely difficult to prepare for computers, but rather to indicate that problem preparation is an item which may cost from $10,000 to $100,000 for problems about which a pure mathematician might comment casually "Oh, that problem is completely understood". In my experience, a typical problem preparation cost is closer to $10,000 than to $1,000.

In many cases a code once prepared can be used by many customers; by spreading these costs over many customers, central computing laboratories bring high-speed computation within reach of the smaller customer and reduce costs for the large customer. The central computing laboratory gradually builds up a larger and larger library of prepared problems which represent an investment in computing know-how. It is hard for the small computer owner to duplicate this, but it becomes available to him when he goes to the central computing laboratory for help.

Efficient Methods for Solving Problems

The second, and most important way, in which a skilled and experienced staff reduces costs is by using efficient methods. It is indeed true that some current computers are very fast. It is even true that there are problems where it is cheaper to use an inefficient method because the computing costs will be negligible in all events, and the coding cost will be lower for the inefficient method. In such cases the inefficient method should be used. However, it is by no means true that modern computers are so fast that inefficient methods can always be used. Many design problems depend on so many parameters that a thoughtless evaluation of some function of all these parameters would be out of the question. For example, if there are 60 design parameters and if it is desired to evaluate the function for only two values of each parameter, and if the computer operates at 100,000 operations per second and there are 10 operations involved in evaluating the function once, then to complete the evaluations it will take the computer working 24 hours a day about three million years.

Partial differential equations are at the root of many problems in industrial research. We have seen methods demonstrated for solving a certain special set of non-linear partial differential equations in two independent variables, which were ten times as efficient as the most common method; that is, the results by the more efficient method were obtained to a given accuracy in 1/10 the time or at 1/10 the cost of the less efficient method. It is our expectation that similar techniques for similar partial differential equations in 3 independent variables would be about 30 times as efficient as the common method. These examples are typical of many others.

Efficiency is acquired by a central computing laboratory by paying good salaries, and by carefully selecting the most experienced and accomplished people in the field. If the prospective computer user has such people on his staff, he is fortunate. If not, he may profit by discussing his problem with a central computing laboratory.

Full Operation with Appropriate Computers

A third way a central computing laboratory keeps down costs is by keeping its computers occupied full time or nearly so. Clearly the cost per hour of useful computing is the total cost of operating the computer for a year divided by the number of hours of useful computing performed during the year. When a computer customer buys a computer, and then is only able to occupy a small fraction of its time because of lack of problems, or lack of staff to prepare problems, or for any other reason, his costs per hour of useful computation will be high. In such cases he is likely to be better off to use the services of a central computing laboratory when possible.

A fourth way in which a central computing laboratory keeps down costs is by using the most suitable computer for a given problem. A properly organized central computing laboratory not only has its own machines but also arrangements with other laboratories for the use of their machines.

For example, some problems have a large amount of computing per unit input and output. Cost may be lower when such a problem is solved on a fast machine with slow input (cheaper rent). Others require very little computation; a slow machine with relatively fast input-output may minimize the cost. When a customer buys a single computer, he may lack this flexibility; at some time he may pay heavily for this lack unless he supplements his own computer by turning some of his problems over to a central computing laboratory.

Service to Industry

Bearing this cost discussion in mind, we discover that a central computing laboratory can serve industry in a number of ways.

If an organization has too little work to justify buying a computer, it can nevertheless enjoy the benefits of modern computing by turning its applied mathematical problems over to a central computing laboratory when this is economically feasible.

If an organization has enough work to justify the purchase of a computer, it may nevertheless gain efficiency by using the services of a central computing laboratory. First, a central computing laboratory can give the organization more time to determine the computer to be bought, by solving its most urgent problems during the investigation per-

iod. This will at the same time bring it into direct practical contact with automatic computation and help it make a better choice.

Furthermore, the central laboratory can supply reserve computing power after the computer is bought. Thus the organization may be able to purchase or rent a cheaper computer, keeping it fully occupied (thus reducing its costs), instead of a more expensive computer fast enough to handle its maximum load, yet idle at some times of minimum load.

If an organization has bought its own computer but cannot afford a large and experienced staff, the central computing laboratory can help it prepare problems for its own machine. This may be particularly important in the early stages; but even later when a new problem arises, it may be advantageous for the customer to draw on the more extensive background of a central computing laboratory.

Finally, as mentioned before, the central computing laboratory is continually compiling a growing library of prepared problems. Therefore, there is an increasing chance that the customer can avoid a large part of problem preparation costs by discussing his problem with the central laboratory.

Kinds of Problems

There are a number of problems well adapted to machine calculation and where a potential computer customer can expect to receive considerable help from a central computing laboratory in their solution.

Probably the most important single problem of applied mathematics is that of solving a system of linear algebraic equations. There is good reason for this. Partial differential equations are local relations between rates of change of variables, and they define the fundamental quantities of physics, chemistry, fluid mechanics, optics, etc. These partial differential equations may be replaced by linear relations between the variables at neighboring points. These equations written at a suitable subset of all points in a region of interest are sufficient to determine in a practical fashion the values of the desired variables in that region. Thus linear systems arise in all fields of science, and by a limiting process they can actually solve non-linear problems. Linear problems arising from this source are of an especially simple form, and may be exploited by appropriate methods. In general, to solve a system of linear equations in n unknowns requires about $\frac{n^3}{3}$ multiplications. The special systems of linear equations mentioned above can be solved with many fewer multiplications. Since n can quite reasonably be 1000, this is a very important simplification.

Typical of directly linear problems well adapted to solution by high-speed computers are the following:

-- The design of frames with rigid joints, for example, frameworks for large structures.

-- The determination of currents, voltages, and powers in complicated steady-state alternating current networks. In this case the coefficients have real and imaginary parts.

A typical problem arising from the field of partial differential equations is that of determining the pressure, density, temperature, and velocity of the air in motion around a moving body such as an airplane or a projectile. The solution of this problem yields such information as the forces acting on the body, the rate at which heat is conducted to or from the body, etc. This information is necessary for design of more efficient shapes.

Another class of problems which is important in industrial management, transportation, and in other fields is called linear programming. The problem in its simplest form is to solve an under-determined set of linear equations, at the same time maximizing or minimizing some function of the unknown variables. For example, the problem of minimizing the cost of distributing freight to different customers in a given number of different ships is a problem in linear programming.

Another class of problems arising from many diverse sources is that of determining the eigen values and vectors of a matrix. One source is the determination of natural vibration modes and amplitudes of a structure. Another source is the solution of a system of ordinary differential equations with constant coefficients. A third source is the determination of the most important variables in terms of which to describe the behavior of other variables (called "factor analysis").

Even this short enumeration of problems, which for their solution require high-speed computers, shows how substantially industrial progress in the future will be benefited by computation. And the central computing laboratory will play an important part in hastening this progress.

ROSTER OF ORGANIZATIONS IN THE FIELD OF COMPUTERS AND AUTOMATION

(Supplement, information as of Nov. 10, 1953)

The purpose of this Roster is to report organizations (all that are known to us) making or developing computing machinery, or systems, or data handling equipment, or equipment for automatic control and materials handling. Each Roster entry when it becomes complete contains: name of the organization, its address, nature of its interest in the field, kinds of activity it engages in, main products in the field, approximate number of employees, year established, and a few comments and current news items. When we do not have complete information, we put down what we have.

We seek to make this Roster as useful and informative as possible, and plan to keep it up to date in each issue. We shall be grateful for any more information, or additions or corrections that any reader is able to send us.

Although we have tried to make the Roster complete and accurate, we assume no liability for any statements expressed or implied.

This listing is a supplement, and contains only revisions or additions as compared with the cumulative edition of the Roster published in the November issue of COMPUTERS AND AUTOMATION, vol. 2, no. 8.

Abbreviations

The key to the abbreviations follows:

Size

Ls	Large size, over 500 employees
Ms	Medium size, 50 to 500 employees
Ss	Small size, under 50 employees (No. in parentheses is approx. no. of employees)

When Established

Le	Long established organization (1922 or earlier)
Me	Organization established a "medium" time ago (1923 to 1941)
Se	Organization established a short time ago (1942 or later) (No. in parentheses is year of establishment)

Interests in Computers and Automation

Dc	Digital computing machinery
Ac	Analog computing machinery
Ic	Incidental interests in computing machinery
Sc	Servomechanisms
Cc	Automatic control machinery
Mc	Automatic materials handling machinery

*C This organization has kindly furnished us with information expressly for the purposes of the Roster and therefore our report is likely to be more complete and accurate than otherwise might be the case. (C for Checking)

*A This organization has placed an advertisement in this issue of COMPUTERS AND AUTOMATION. For more information, see their advertisement. (A for advertisement)

Beckman Instruments Inc., South Pasadena, Calif. *C "Analog-digital" converter. Special purpose control computers. EASE computer (Electronic Analog Simulating Equipment). Ls(1000) Me(1934) DAc RMSa SEE Berkeley Division, Beckman Instruments

Bendix Aviation Corporation, Computer Division, 5630 Arbor Vitae St., Los Angeles 45, Calif. *C Electronic information-processing machines. Electronic computers; data-processing equipment; automatic control systems; Decimal Digital Differential Analyzer (exhibited at Wayne Univ., Detroit, Aug. 1953). Ms(30) Se(1952) DACc RMSPa

Bendix Aviation Corp., Pacific Division, North Hollywood, Calif. *C Telemetering systems. Digital systems, controls, and components. Ls(2500) Le(1915, company; 1937, this division) Ic RMSa

Birkbeck College, University of London, London, England. *C Maker of ARC, APEXC, and SEC digital computers; electronic digital computers. Ss(10 to 20) Se(1946) Dc RCPa

Clary Multiplier Corp., 408 Junipero St., San Gabriel, Calif. *C Adding and calculating machines, cash registers, electronic counters, analog-digital converters, input and output equipment for computers, data-reduction systems. Ls(1500) Me(1939) DAc RMSa

Eckert-Mauchly Division, Remington Rand, Inc., 3747 Ridge Ave., Philadelphia, Pa., and elsewhere *C, *A All purpose electronic digital computers. Univac Factronic System. Ls(600)? Se(1946) Dc RCMSa SEE also Remington Rand, Inc.

Elliott Bros. (London) Ltd., Century-Works, Lewisham, London, S.E. 13, England, and Computer Division at Research Laboratories, Elstree Way, Borehamwood, Herts., England. *C Digital and analog computers; servomechanisms. Ls(3000) Le(1800) DASc RMSa

Engineering Research Associates, Div. of Remington Rand, Inc., 1907 West Minnehaha Ave., St. Paul, Minn., and 510 18th St. South, Arlington, Va. *C, *A Digital computers; ERA 1101 and 1103 electronic digital computers; the Logistics Computer. Magnetic storage systems, including magnetic heads, magnetic drums, etc. Shaft-position indicator systems, self-recording accelerometers, analog magnetic recording systems, data-handling equipment, special purpose communications equipment, pulse transformers. Ls(750) Se(1946) Dc RMCPSa SEE also Remington Rand, Inc.

Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y., agent for Ferranti Electric Ltd., Moston, England, and Mount Dennis, Toronto, Canada. *C Complete electronic digital computers (Ferranti; also called "Manchester Universal Electronic Computer"). High-speed photoelectric tape reader, which can read up to 200 characters per second. Magnetic drum and electrostatic storage components, etc. Ls(10,000) Le(1896) Dc RMSa

Intelligent Machines Research Corp., 134 So. Wayne St., Arlington, Va. *C, *A
Devices for reading characters on paper,etc. Pattern interpretation equipment. Sensing mechanisms. Digital computer elements. Ss(10) Se(1951) Dc RCMSa

Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena 3, Calif. *C
Analog, digital, and data-handling systems. Research and development in jet propulsion and missile guidance. Ls(1000; about 50 on computers) Me(1942) DAc RCPa

Laboratory for Electronics, 51 Pitts St., Boston 14, Mass. *C, *A
Analog and digital computers, special computers to suit customer requirements, delay lines (mercury, quartz), plug-in packages for computer applications, etc. Ls(700) Se(1946) DAc RMSa

Librascope, Inc., 1607 Flower St., Glendale 1, Calif. *C
Mechanical and electrical analog computers; primarily special-purpose. All phases of data-handling. Ls(600; about 30 on computers) Me(1937) DASc RMSa

Logistics Research Inc., 141 So. Pacific Ave., Redondo Beach, Calif. *C, *A
Digital computers and computing systems (ALWAC). Data-reduction and data-handling systems, input and output equipment, automatic graph-plotters, large scale magnetic memories with "air-floated" magnetic heads, etc. Ss(35) Se(1952) DIc RMSa

Monrobot Corp., Morris Plains, N.J. *C, *A
Monrobot automatic electronic digital computers. Subsidiary of Monroe Calculating Machine Co. Ss(32) Se(1952) Dc RMSa

Radio Corp. of America, RCA Laboratories Division, Princeton, N.J.; RCA Victor Div., Camden, N.J. *C
Selective electrostatic storage tube (formerly Selectron), Radechon, Graphecon, Williams Tube, Time Interval Counter; computer systems. Magnetic matrix memory. Ls Le Ic RMSa

Raytheon Manufacturing Co., Waltham, Mass. *C, *A
Electronic digital computer systems for scientific applications (RAYDAC), and for general accounting and data-handling applications. Tape-handling mechanisms, magnetic heads, magnetic shift registers, and other computer components and sub-systems. Computing service to analyze problems in applied mathematics, in engineering, and in industrial logistics by digital computer. Radar, fire control, microwave equipment, etc. Ls(20,000) Me(1925) DAc RMSa

Remington Rand, Inc., 315 4th Ave., New York 10, N.Y., and elsewhere. *C, *A
Punched card machines, office machines, electronic digital computing systems (Univac Factronic System, ERA 1101, ERA 1103), servomechanisms. Ls(30,000; 1800 on computers) Le DASc RCMSa SEE also Eckert-Mauchly Division, and Engineering Research Associates Division.

Sylvania Electric Co., Radio and Television Division, 70 Forsyth St., Boston 15, Mass. *C, *A
Electronic digital computers using printed circuit techniques. Subassemblies of diodes and triodes. Ls(2200; this division, 190) Le(1901; this division, 1945) DAc RMSa

Taller and Cooper, 75 Front St., Brooklyn, N.Y. *C
Data recording and conversion systems, printers, perforators, analog to digital converters. Function generators, computers. Toll equipment for bridges, highways, turnpikes. Ms(250) Me(1926) DIc RMSa

ROSTER OF ORGANIZATIONS MAKING COMPONENTS
(Information as of Nov. 10, 1953)

The purpose of this roster is to report organizations making components (but not making complete systems) that enter into computing machinery or data-handling equipment or equipment for automatic control and materials handling. Since this would be a very large list if we included all organizations making motors, resistors, magnetic cores, condensers, etc., this roster is not a free listing. For the conditions of listing, see page 31; also the listing is subject to editing for completeness and objectivity; for the abbreviations, see the "Roster of Organizations in the Field of Automatic Computers and Automation".

ROSTER

Alden Electronic and Impulse Recording Equipment Co., Alden Research Center, Westboro, Mass. *A
Facsimile recording equipment and facsimile components. Ma SEE Alden Products Co.

Alden Products Co., 117 No. Main St., Brockton, Mass. *A
General and specific components for digital and analog computing machinery; plug-in components, sensing and indicating components, magnetic delay line units, magnetic storage cores, etc. Ms(300) Me(1930) Ic RMSa

Alfax Paper and Engineering Co., Alden Research Center, Westboro, Mass. *A
Electrosensitive recording papers. Ma SEE Alden Products Co.

Ferroxcube Corporation of America, 377 East Bridge St., Saugerties, N.Y. *A
Ferrite core materials, including pot cores, cup cores, recording heads, and microminiature toroids with square hysteresis loop. Magnadur permanent magnet materials. Ms(100) Se Ic RMSa

Sprague Electric Co., 377 Marshall St., North Adams, Mass. *A
Capacitors: miniature, and low dielectric hysteresis loss, for computer applications. Standard capacitors; precision and power type resistors; pulse transformers; radio interference filters. Ls Ic RMSa

"COMBINED" OPERATIONS IN A LIFE INSURANCE COMPANY INSTEAD OF "FRACTURED" OPERATIONS

R. T. Wiseman, Sun Life Assurance Co. of Canada,
Montreal, Canada

(based on a talk at the Association for Computing Machinery meeting,
Cambridge, Mass., September 11, 1953)

Although we have been working on applications of electronic equipment in our company for a considerable time, I must confess that we know very little about the construction of the machines. Nevertheless, we have become somewhat proficient in programming; and we do have a quite thorough knowledge of the life insurance business. Such is our background, and it is probably typical of the average commercial concern. With this background, we have managed to design a routine and program it for several automatic computers, and we have actually made a test on a Remington Rand Univac. The results have been very promising.

Before reporting on these results, however, let me sketch briefly some details of the life insurance background.

Life Insurance Clerical Operations

A heavy load of clerical work is needed to service life insurance policies. Much of this work is of an accounting or mathematical nature. We have in the past succeeded in economizing the amount of this work by separating out different operations and delegating them to different divisions of the Company. Each division has its own appropriately designed records of the policy, so that it is able to perform its particular operation.

In our company there are at present at least nine records for every policy issued. Nine is the minimum: if many additional features occur in the policy, more than twenty separate records may be required. To reduce the amount of calculation, we have set up large files of factors, for example, in reserve liability and dividend calculations. In other words, because the cost of computation up to now is very much higher than the cost of maintaining files up to now, we have separated our operations and keep many files.

When our operations are thus "fractured", a great bulk of them can be scheduled well, are highly repetitive, and lend themselves to present mechanical methods. But these mechanical methods have had two serious limitations: first, a limitation in capacity -- for example, the amount of data that can be put on a punch card or into a register of an accounting machine; second, mechanical computing routines have had to be quite short, with the result that there is only a limited possibility for varying computation procedures.

To overcome these limitations, we have had to break down the separated operations even further into successive stages. For example, in many punch card mechanical procedures, the cards progress through more than twenty successive stages.

With all this intensive "fracturing", our operations have attained literally a very broken-down condition. But that has been the best way that we could accommodate our operations to (1) the relative cheapness of filing operations as compared to the relative expense of computation; (2) the limited data capacity of the mechanical equipment; and (3) the limited processing ability of this equipment. These three conditions virtually dictated our procedures.

Electronic Equipment

And now electronic equipment has altered all these conditions.

You can readily see that the old procedures are not the most suitable for the new type of machine. Our earlier investigations convinced us that a more effective approach was a "combined operations" approach. In other words, we would perform simultaneously from one record many of those operations which we had performed separately in the past from many records. This might require the use of longer and more varied computation formulas, and perhaps larger records. But we have become convinced that the combined operations method would give a substantial saving.

The new routine we have decided on rests basically on the premium billing process. This process must be carried out according to a schedule as premiums fall due. Other operations which have been combined with premium billing in the new routine are as follows:

calculation of the reserve; calculation of the policy dividend; allocation of the dividend according to the policy-holder's selection; calculation of policy loan interest; analysis of accounts; exhibits of movement of business; calculation of cash surrender value; prior determination of the effects of default in premium so that the collection offices have adequate guidance; extraction of policies which according to the plan of insurance require some attention in the future, for example, maturing endowments; and a number of other, relatively minor, operations.

A considerable increase in the amount of data on the unit record is required to carry out this "combined operation" routine. The operation of premium billing itself requires a unit record providing for more than 200 alphabetic and decimal characters. In order to combine the other operations, we found we had to expand the unit record to provide for approximately 600 characters. This may seem to be a bulky unit record, but it replaces 14 records in 14 separate files now used to carry out the same operations. For a group of 700,000 policies, these 14 records now occupy 2,600 square feet of valuable office space. We estimate that the combined record for this group of policies can be placed on 500 reels of magnetic tape and stored in about 1% of this office area.

The mathematical processes used with the combined record are much longer than those used in the past. They also allow for a great number of variations for different types of policies. Not one of these processes is complex in itself, but there are so many of them that the total picture is rather intricate. However, the advantages that come from the combined procedure are readily seen; for example, let us look at the alternate methods for calculating policy dividends.

In life insurance in a mutual company like ours, a dividend on an insurance policy is a refund of the excess portion of the premium. This excess arises from conservative assumptions in the long-term forecast of future mortality, interest, and expense rates. In the past, we calculated the combined effects of these three elements, and set up a table of dividend factors, a separate factor arising for every plan, age at issue, and year of issue. For each calendar year of dividend, the table contained some 300,000 factors. For each policy, a clerk referring to the dividend factor table picks out the approximate dividend rate, multiplies it by the fact amount of the policy, and enters the result on the file record.

In the combined operations procedure, the unit record contains more complete details of the policy, so that we are able to calculate each of the three elements, and then simply add the results together to obtain the total dividend. For instance, that portion arising from interest is determined by applying the excess interest rate to the funds on hand (or, in other words, the reserve). The combined operations method of approach eliminates the necessity of referring to the large factor file of dividends.

The machine program in the combined operations procedure calls for three inputs as follows:

(1) A "master" tape containing the file of unit records as of the last date of processing.

(2) A "change" tape containing data for amending the file because of unscheduled changes which occurred since the last date of processing. (For example, the granting or repayment of a policy loan, or a change of address of the policyholder.)

(3) A "Program" tape containing factors and calculating routines, for amending the tape for those cases where some transaction is scheduled to take place.

There are four output tapes, as follows:

(1) An up-to-date master tape.

(2) A "billing and accounting" tape, which contains data for writing the Company's accounts and for preparing notices to the policyholders and collection offices.

(3) A "schedule" tape, which is a copy of the unit records for those policies which require some special service in the near future. (For example, maturing endowments and expiring benefits.)

(4) An "exceptions" tape, which we hope will be small, for it is a copy of unit records for those cases where some consistency check has failed.

The unit records are indeed bulky, and the computing processes long and intricate. If such an operation were to be attempted on a manual basis, a good clerk would probably service about two policies per day. Yet in our actual test on Univac, the machine processed policies at the rate of two per <u>second</u>. Furthermore, this test group was rather heavily loaded with special problems, which slowed down the routine considerably. With a more representative sample, and with some improvements in programming, which became clear from that test, we believe the machine can process <u>four</u> policies per second.

From the technical point of view, this approach brings a number of advantages. We think the closer correlation of the now separated operations will result in greater accuracy. Many of the inventory jobs now being performed, notably reserve liability, will be spread throughout the year and avoid the heavy year-end load of this type of work up to now. Furthermore, the statement of the Company's condition throughout the year should be more accurate than our present system of estimating between inventory dates.

Effects on Staff

What are the effects of Univac on staff? It is clear that a major reorganization must take place when the combined operation procedure replaces the present segregated operation procedure. In the case of supervisory staff, it is no less clear that there will be problems in reassigning those men who are now responsible for some fractured segment of the total operation. In fact radical adjustments will be necessary which, in some instances, may be painful. We hope such cases will not be too frequent, but believe this may be rather a vain hope.

But what about non-supervisory staff? Here we think the adjustments will be painless. Certainly we will require reductions in staff in order to justify the purchase of such expensive electronic equipment. But this can be accomplished simply by reducing the rate of hiring during the conversion period; no one who is currently employed need be dismissed. Neither does it seem we need worry about the jobs we are eliminating for potential staff. In these times, when there is a dearth of new employees coming out of the schools (because of the low birth-rate in the 30's), any reduction in demand is welcome.

Most particularly we are hopeful about the effect the new approach will have on the content of the clerical job. One of the results of the extremely fractured, mechanized type of operation of the past is the virtual absence of intellectual stimulation in the job. The clerk in charge of one segregated stage of a segregated operation has found little to excite his or her interest. This has been a frequent complaint in the past. And as we became more mechanized on the older type of equipment, we often found our clerical staff more interested in mastering the machine than mastering the insurance work to be done. We believe the combined operations procedure will re-educate our staff -- will make them insurance-minded, rather than machine-minded.

In fact, looking at the prospects for improved procedure, for economy, for jobs more satisfying to our clerical staff, I feel like saying what a Mr. Henry said long ago: "All this and Heaven too."

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Manuscripts. We desire to publish articles that are factual, useful, understandable, and interesting to many kinds of people engaged in one part or another of the field of computers and automation. In this audience are many people who have expert knowledge of some part of the field, but who are laymen in other parts of it. Consequently, a writer should seek to explain his subject, and show its context and significance. He should define unfamiliar terms, or use them in a way that makes their meaning unmistakable. He should identify unfamiliar persons with a few words. He should use examples, comparisons, analogies, etc., whenever they may help readers to understand a difficult point. He should give data supporting his argument and evidence for his assertions. An article may certainly be controsial if the subject is discussed reasonably. Ordinarily, the length should be 1000 to 4000 words, and payment will be $10 to $50 on acceptance. A suggestion for an article should be submitted to us before too much work is done. To be considered for any particular issue, the manuscript should be in our hands by the 5th of the preceding month.

"CAN MACHINES THINK?" -- DISCUSSION

I. By James L. Rogers, Burroughs Research Division, Philadelphia, Pa.

It seems to me that the discussions have overlooked the essential point. I refer to the fact that the question of machines' thinking cannot be answered until the asker states clearly what he means by "thinking". While this observation is usually dismissed as trivial (since it is true of any answer to any question), it has a special force in this particular context. As von Neumann put it in his article "The General and Logical Theory of Automata", appearing in "Cerebral Mechanisms in Behavior", Wiley, 1951:

> "The McCulloch-Pitts result....proves that anything that can be exhaustively and unambiguously described, anything that can be completely and unambiguously put into words, is ipso facto realizable by a suitable finite neural network. Since the converse statement is obvious, we can therefore say that there is no difference between the possibility of describing a real or imagined mode of behavior completely unambiguously in words, and the possibility of realizing it by a finite formal neural network."

This puts those who claim that machines cannot "think" into a very uncomfortable position. For if they can clearly and completely specify what they mean by "thinking", it follows that a network of logical elements can be designed to do it. Of course, if they cannot clearly state what they mean by "thinking", the question should not have been asked in the first place.

The above argument applies with equal force to any of the various attempts to avoid the main issue by presenting a list of specific tasks which, it is claimed, no machine could ever perform. For example, it has been suggested that no machine is capable of composing poetry. Here again, if specifications for what constitutes "poetry" are provided, the circuit is designable. If they are not, the objection is empty.

II. By Alston S. Householder, Oak Ridge National Laboratory, Oak Ridge, Tenn.

In these days of specialization, scientists often find it difficult to communicate even with one another; and few scientists have the ability, or make the effort, to communicate with laymen concerning their specialties. Language is the primary vehicle of communication between human beings, and assuredly it behooves us to select our language, so far as possible, so as to facilitate communication, and not to impede it.

Now if one chooses to apply the term "thinking" to designate the operations, or some of the operations, of certain types of machinery, what purpose is served? Certainly it solves no problems. For certainly the operation of any machine is better understood, and more understandable, than most of the processes (i.e., in living beings) that are usually so called. There seem to be three possibilities: The term may arise out of an attitude on the part of the speaker toward the machine and its operation; or it may be employed for the purpose of arousing a particular attitude

on the part of the hearer; or the speaker may feel that use of the term will assist him in conveying information. These three possibilities are, of course, not exclusive.

If the speaker's purpose is to convey information, the word seems poorly chosen. A potential purchaser of a Remington Rand Univac, or renter of an IBM Type 701, will be but little enlightened if he is told that the machine thinks. He will ask for elucidation, and the speaker must then list the operations the machine can perform, which he might as well have done at the start.

If the speaker is expressing his own feeling about some machine or machines, there can be no quarrel with him. One has every right to stand in awe and admiration before a superlative creation.

To be explicit, it seems to me that the immediate practical problem is that expressed by Rudolf Flesch in his title, "How to Talk about Computers"; that in talking one should choose terms that convey a maximum of information and are subject to minimal dangers of misunderstanding; and that the word "thinking" in this context satisfies neither of these criteria.

I would not deny that a legitimate theoretical problem remains, but I would not phrase it in G. G. Hawley's, terms, or Samuel A. Scharff's, or E. C. Berkeley's. The question "Do machines think?" seems to me to be a meaningless question, not because one has doubts about what machines can do, but because the verb "think" is not well defined, and is burdened with emotional overtones. But since at any rate thinking, in at least some of its many forms, is commonly regarded as profitable activity, one can legitimately ask, "How many of these forms of useful activity can machines be made to perform?" But this question, phrased in the vernacular, amounts merely to this: "How fancy can you be in designing machines?"

But if the speaker hopes to engender an attitude, one may ask if he is well advised. Already the anti-intellectualists are pointing to the "super-mathematicians" as justifying de-emphasis of arithmetic in the schools. Scientists may enjoy having the lay public admire an achievement, but will they not admire it best who can see it in perspective, divested of any aura of mystery?

The editor of COMPUTERS AND AUTOMATION observes that the subject of machines' "thinking" has caused more discussion and more interesting disagreements than any other subject so far discussed in these pages. It seems clear that those who consider that machines can think will in the long run carry on different research and work for different goals, from those who do not; the viewpoint affects behavior. Continued discussion is invited. -- E.C.B.

GLOSSARY -- Section 3: F to Z

(First edition, section 3, cumulative, November, 1953)

The following is a glossary of terms used in the field of computers and automation. It is the purpose of this glossary to report the meanings of terms as used, and not to legislate about them. "Section 1: A, B" of this glossary was published in COMPUTERS AND AUTOMATION, March, 1953, vol. 2 no. 2. "Section 2: C, D, E" of this glossary was published in the May, 1953, issue, vol. 2, no. 4. Additions, comments, corrections, and criticisms will be appreciated.

F: fixed cycle operation -- in a computer, organization whereby a fixed time is allocated to operations, although they may actually take less time than is allocated; the type of operation of a "synchronous" computer.

fixed point calculation -- in a computer, calculation using or assuming a fixed or constant location of the decimal point or the binary point wherein each number is specified by its coefficient, exponent, and sign.

flip-flop -- an electronic circuit having two input lines and two corresponding output lines such that a signal exists on either one of the output lines if and only if the last pulse received by the flip-flop is on the corresponding input line.

floating point -- in a computer, calculation taking into account varying location of the decimal point (if base 10) or binary point (if base 2), and consisting of writing each number by specifying separately its sign, its coefficient, and its exponent affecting the base. For example, in floating-point calculation, the number -638,020,000 might be reported as -,6.3802,8 = -6.3802×10^8.

four-address -- in programming, a system of instructions wherein each complete instruction specifies the operation, the addresses of four registers, usually containing two or three operands (i.e., the numbers to be operated on), the result to be formed, and the next order.

function table -- (1) a table of the values for a mathematical function; (2) in a computer, equipment for translating from one representation of information to another representation.

G: gate -- an electronic circuit with two inputs and one output, which has the property that a pulse goes out on the output line if and only if some specified combination of pulses (such as presence on one and absence on the other) occurs on the two input lines.

H: head -- in computer discussion, same as "magnetic head", i.e., a small electromagnet used for reading, recording or erasing polarized spots on magnetic surface.

I: infinity -- in a computer, any number larger than the maximum number that the computer is able to store in any register.

information -- basically, a set of marks or an arrangement of equipment that has meaning.

information word -- (1) machine word; (2) the information content of a machine word.

input unit -- in a computer, the unit which takes in information from outside the computer.

instruction -- in a computer, a word or a set of characters which directs the computer to take a given action.
internal memory -- in a computer, the total memory which is accessible automatically to the computer without human intervention.

L: latency -- in programming, delay while waiting for information called for from the memory to be delivered to the arithmetic unit.
library of routines -- for a computer, the collection of standard programs or routines by means of which many types of problems or parts of problems may be solved.
line-at-a-time printing -- printing of a whole line of characters at one time, usually by means of one typebar (bearing all characters) for each character space in one line.
logic -- in computer discussion, same as "logical design", which see.
logical comparison -- the operation of comparing A and B; the result is 1 if A is the same as B and 0 if A is not the same as B (or vice versa).
logical design -- in a computer, design that deals with the logical and mathematical interrelationships that must be implemented by the hardware.
logical operations -- in computer discussion, operations such as comparing, selecting, making references, matching, sorting, merging, etc., where in essence ones and zeros corresponding to yeses and noes are taken into account in the calculation.

M: machine cycle -- in a computer, the smallest period of time or complete process of action that repeats itself in order. In some computers, "minor cycles" and "major cycles" are distinguished.
machine language -- information in the physical form which a computer can handle. For example, punched paper tape is machine language, while printed characters on paper are not usually machine language.
machine word -- in a digital computer, a unit of information of a standard number of characters, which a machine regularly handles in each register. For example, a machine may regularly handle numbers or instructions in units of 36 binary digits: this is then the "machine word".
magnetic core -- a form of storage where information is represented as the polarization north-south or south-north of a wire-wound core, which may be straight, doughnut-shaped, etc.
magnetic head -- a small electromagnet used for reading, recording, or erasing polarized spots on a magnetic surface.
magnetic drum -- a rapidly rotating cylinder, the surface of which is coated with a magnetic material on which information may be stored as small polarized spots.
magnetic memory -- in a computer, any portion of the memory which makes use of magnetic properties of materials.
magnetic tape -- tape made of paper, metal, or plastic, coated or impregnated with magnetic material, on which polarized spots representing information may be stored.
magnetic wire -- wire made of magnetic material on which polarized spots representing information may be stored.
marginal checking -- in computer construction, a system of designing electronic circuits so that the voltage of the heaters of the tubes, ordinarily established at 6.3 volts, may be lowered if desired to 5 or 4.7 volts, and the circuits then tested to determine if they still continue to operate satisfactorily.

mathematical logic -- exact reasoning about nonnumerical relations using symbols that are efficient in calculation. Also called "symbolic logic".

memory -- in a computer, the units which store information in the form of the arrangement of hardware or equipment in one way or another.

mercury memory -- in a computer, delay lines using mercury as the medium for storage of a circulating train of waves or pulses.

mercury tank -- a container of mercury holding one or more delay lines storing information.

merging -- combining two sequences of items of information in any way such that the same sequence is observed in the combined sequence. For example, sequence 12, 29, 42 and sequence 23, 24, 48 may be merged into 12, 23, 24, 29, 42, 48. Same as "collating".

microsecond -- a millionth of a second.

millisecond -- a thousandth of a second.

minimum access programming -- programming for a computer in such a way that minimum time is required to obtain information out of the memory. Also called "minimum latency programming", "interlacing" or "forced coding".

minimum latency programming -- same as "minimum access programming".

modulo n check -- a form of checking digits in the computer, such that the number of ones in each number A operated with is compared with a check number B carried along with A equal to the remainder of A when divided by n. For example, in a "modulo 4 check", the check numbers will be 0,1,2,or 3, and the remainder of A when divided by 4 must equal the reported check number B, or a mistake has occurred.

N: numeric coding -- a system of coding or abbreviation in the preparation of machine language such that all information is reported in numbers. For example, ten places such as Boston, New York, Philadelphia, Washington, etc., may be reported as decimal digits 0,1,2,3 ...., whereas in "alphabetic coding" alphabetic abbreviations BO,NY,PH,WA, ... would be acceptable to the machine.

O: octal digit -- one of the symbols 0,1,2,3,4,5,6,7 when used as a digit in numbering in the scale of eight.

octal notation -- notation of numbers in the scale of eight. For example, the number 217 in this scale means 2 times 8 squared (2 x 64 = 128), plus 1 times 8, plus 7, which equals 143 in decimal notation. The number 217 in octal is equal to 010,001,111 in binary, each octal digit being changed directly into its binary equivalent. The octal notation is rather convenient in dealing with binary machines because the octal numbers are easier for human beings to read than binary numbers, and yet the conversion is immediate.

odd-even check -- use of a digit carried along as a check which is 1 if the total number of ones in the machine word is even, and which is 0 if the total number of ones in the machine word is odd, or vice versa.

one-address -- in programming, a system of instructions whereby each complete instruction includes an operation and specifies the location of one register in the memory. Also called "single-address".

on-line -- in scheduling, a process whereby each step in the scheduled process is carried out fast enough so that no delay anywhere in the process results. For example, on-line data reduction is reduction of data just as fast as it flows into the reduction process.

operand -- a number used in an operation.

operating ratio -- in computer operation, the ratio obtained by dividing (1) the total number of hours of correct machine operation (including time when the program is incorrect through human mistakes) by (2) the total number of hours of sched-

uled computer operation including preventive maintenance. For example, if the computer is scheduled for three shifts totaling 120 hours in a week, and if "preventive maintenance" takes 12 hours, and "unscheduled down-time" amounts to 3 hours, then the "operating ratio" is 87½%.

operator -- the person who actually operates the computer, puts problems on, presses the start button, etc.

output unit -- in a computer, the unit which delivers information outside the computer in acceptable language.

overflow -- in a counter or register, the production of a number which is beyond the capacity of the counter.

P: parallel operation -- in a computer, the flow of information through the machine or in any part of it using two or more lines or channels simultaneously.

permanent memory -- in a computer, storage of information which remains intact when the power is turned off; for example, storage on a magnetic drum.

plugboard -- in a computer, a removable board holding many hundreds of electric terminals into which short connecting wire cords may be plugged in patterns varying for different programs for the machine; to change the program, one wired-up plugboard is removed and another wired-up plugboard is inserted.

plug-in-unit -- a subassembly of tubes, resistors, condensers, diodes, etc., wired together, which is of a standard type and which as a whole can be plugged in or pulled out easily.

precision -- in a computer, the degree of exactness with which a quantity is stated, as contrasted with "accuracy", which is the degree of exactness with which a quantity is known or observed. The number of significant figures measures the precision of a number. For example, in "computer power required is 55.7843 kilowatts," the number is precise to six figures, but its accuracy certainly is much less.

printer -- an output mechanism which prints or typewrites characters.

program -- in a computer, a sequence of instructions for solving a problem.

program step -- a step in a program, usually one instruction.

programmed checking -- in computer operation, a system of checking whereby (1) before running any problem P a smaple problem of the same type with known answer is run, and (2) mathematical or logical checks of operations, such as comparing A x B with B x A, are included in the program for P, and (3) reliance is placed on a very high probability of correctness rather than built-in error-detection circuits.

program-sensitive error -- in a computer, an error arising from unforeseen behavior of some circuits, discovered when a comparatively unusual combination of program steps occurs.

programmer -- a person who prepares a sequences of instructions for a computer, without necessarily converting them into the detailed codes.

program register -- in the control unit of a computer, the register which stores the current instruction of the program and thereby completely controls the operation of the computer during the cycle of execution of that instruction.

program tape -- in a computer, the tape which contains the sequence of instructions to the computer for solving a problem.

pulse -- in general, the difference between the normal level of some medium, and a high or low level of that medium corresponding to the crest or trough of a wave; often, a sharp voltage change.

punch card -- in computer discussion, usually a card of constant size and shape, suitable for punching in a pattern that has meaning, and for being handled mechanically. The punched holes are usually sensed electrically by wire brushes or mechanically by metal fingers.

punch card machinery -- machinery which operates with punch cards.
punched tape -- paper tape punched in a pattern of holes so as to convey information.
punch position -- with 80-column punch cards, the position of a punch in a row on the card, denoting a decimal digit 0 to 9, or what are called an "X punch" (row 11), or a "Y punch" (row 12).

R: random access -- in a computer, access to the memory under conditions where the next register from which information is to be obtained is chosen at random. For example, access to names in the telephone book is "random access"; the next name that anyone is going to look up in the book may be almost anywhere in the book with roughly equal probability.
random access programming -- programming a problem for a machine without regard to the time for access to the information in the registers called for in the program. Contrasted with "minimum access programming."
rapid memory -- in a computer, the section of the whole memory from which information may be obtained fastest.
read-around-ratio -- in cathode-ray-tube storage in a computer, the number of times that information can be recorded successively as an electrostatic charge on a single spot in the array, before the charge on surrounding spots in the array must be restored if not to be lost.
reading -- taking information out of a register in a computer.
reading in -- putting information into a register of a computer.
reading out -- taking information out of a register in a computer.
real time -- in solving a problem, a speed sufficient to give an answer in the actual time during which the problem must be solved. For example, in the case of a human being driving a motor car: at 30 miles an hour he can regularly solve nearly all his problems in real time; and at 100 miles an hour he will regularly fail to solve some of his problems in real time.
real time operation -- in computer operation, solving problems in real time.
reel -- a spool of tape, generally magnetic tape.
regenerating -- in the operation of electrostatic storage, restoring the neighboring spots of charge before losing them. See "read-around-ratio".
register -- in a computer, the equipment for storing one machine word.
repetition rate -- in a computer, the fastest rate of electronic pulses usually used in the circuits of the machine.
reproducer -- a punch card machine that punches cards to agree as may be specified with other cards.
rounding off -- in computation, changing a precise number to a less precise one, usually choosing the nearest less precise one; see "precision".
routine -- usually a short or repeated sequence of instructions occurring in a program for a machine to solve a program; sometimes the whole program.

S: scale factor -- in computation, one or more factors used to multiply or divide quantities occurring in a problem and convert them into a desired range such as the range from plus one to minus one.
scaling -- applying scale factors.
screen -- in an electrostatic storage tube, the surface where electrostatic charges are stored; in a pentode, one of the grids.
selecting -- in logical operations, taking A if the report on a certain condition is yes, and taking B if the report is no.
selector -- in punch card machinery, a mechanism which reports a condition and causes a card or an operation to be selected accordingly.
sequence-control tape -- program tape (obsolescent term).

sequencer -- in punch card machinery, a mechanism which will put items of information in sequence.

sequencing -- in punch card machinery, selecting A if A is greater than or equal to B, and selecting B if A is less than B, or some variation of this.

serial operation -- in a computer, the flow of information through the machine or in any part of it using only one line or channel at a time. Contrasted with "parallel operation."

shifting -- in a computer, in essence multiplying or dividing a number by a power of the base of notation (usually ten or two). This is regularly performed as a special rapid operation, much faster than the usual multiplication.

single-address -- same as "one-address", which see.

slow memory -- in a computer, sections of the memory from which information may be obtained automatically but not at the fastest rate of the several sections.

sonic delay line -- a delay line which uses pulses in the molecules of the medium, in contrast with an electrical delay line which uses electrical pulses in a wire or in an assembly of coils and capacitors.

sorter -- a punch card machine which sorts cards according to the punches in a specified column of the card.

sorting -- in logical operation, arranging items of information in groups according to previously chosen classes of items.

storage -- in a computer, the unit which holds or retains items of information.

storage register -- in a computer, a register in the memory or storage of the computer, in contrast with a register in one of the other units of the computer.

subprogram -- a part of a program.

subroutine -- a short or repeated sequence of instructions for a machine to solve a part of a problem.

summary punch -- a punch card machine which may be attached by a many-wire cable to another machine (for example, a tabulator), and which will punch out on a card the information produced or calculated or summarized by the other machine.

symbolic logic -- exact reasoning about nonnumerical relations using symbols that are efficient in calculation. A branch of this subject known as Boolean algebra has been of considerable assistance in the logical design of computing circuits. Also called "mathematical logic".

synchronous computer -- an automatic digital computer where the performance of all ordinary operations starts with equally spaced signals from a master clock.

T: tabulator -- a punch card machine which takes in punch cards and instructions and produces listings or tabulations of the information on separate forms or on continuous paper.

tape -- in computer discussion, usually magnetic tape or punched paper tape.

tape feed -- a machine or mechanism which will feed tape to be read by a mechanism.

three-address -- in programming, a system of instructions whereby each complete instruction includes an operation and specifies the location of three registers, usually two registers for operands and one for result.

transferring -- in a computer, copying information from one register into another register without modification of the information.

transfer check -- a check that an operation of transferring has been correctly carried out.

translating -- in a computer discussion, changing information from one form of machine language into another form of machine language, without however changing the meaning to any significant extent.

troubleshooting -- locating the cause of computer malfunctioning.

truncating -- in mathematical operations, dropping digits of a number thus lessening precision. See "precision". For example, the number pi "3.14159265 ...." is "truncated" to three figures in "3.14".

two-address -- in programming, a system of instructions whereby each complete instruction includes an operation and specifies the location of two registers, usually one containing an operand and the other the result of the operation.

V: variable cycle operation -- operation of a computer whereby any cycle of operation may be longer or shorter than the average. This is the kind of operation in an "asynchronous computer".

verifier -- a punch card machine operated manually which reports by signals whether punched holes have been inserted in the wrong places or have not been inserted.

verifying -- in preparing information for a computer, making certain that the information as prepared is correct.

volatile memory -- in a computer, memory or storage having the property that if the power is turned off, the information vanishes. For example, delay line memory is volatile.

W: Williams tube -- in a computer, a cathode-ray-tube for storing information of the type designed by F. C. Williams of the University of Manchester, England.

word -- in a digital computer, a unit of information of a standard number of characters which a machine regularly handles in each register. For example, a machine may regularly handle numbers or instructions in units of 36 binary digits; this is then a "word" or "machine word".

writing -- in a computer, recording information into a register or onto a medium.

FORUM

1. Machine Translation Newsletter. From Professor William N. Locke, Dept. of Modern Languages, and V.H. Yngve, Research Laboratory of Electronics, Mass. Inst. of Technology, Cambridge 39, Mass.:

Since 1947, interest has been developing in this country as to the possibility of translating from one language to another by an automatic or semi-automatic machine.

It has occurred to us at M.I.T. that it might be worthwhile to provide a clearing house for these developments. We are preparing a mailing list of people to whom we will send an informal news letter from time to time. The first issue will be a bibliography of machine translation to date. ....

If any reader of COMPUTERS AND AUTOMATION is interested in machine translation, and would like to receive the newsletter, we suggest that he send his name to Professor Locke at M.I.T.

Professor Locke says that it is not anticipated that the newsletter will publish articles or papers. However, we are interested in publishing articles (see Booth's article in the May issue of COMPUTERS AND AUTOMATION and Bar-Hillel's article in the July issue). And the "Journal of the Association for Computing Machinery" (Editor Franz L. Alt, National Bureau of Standards, Washington 25, D.C., first issue probably January 1954) would appear to be a logical place to submit papers.

* * *

2. Excerpt from "Newsweek", of November 2, 1953: Reporting on article "Air-Floating: A New Principle in Magnetic Recording of Information" by Glenn E. Hagen in the November issue of COMPUTERS AND AUTOMATION:

PARLOR MAGIC ... Stick a pin through a small square of stiff paper. Insert the pin in the hole of a spool of thread ... blow through the opposite end of the spool ... Hagen got a flash of inspiration. Parlor magic would solve a most annoying problem ... As Hagen pointed out this week in the journal Computers and Automation, about the handiest way of storing information so that it can be referred to easily and quickly is the so-called magnetic drum. ... The trouble has been to keep the heads exactly positioned just above the surface of the drum. ... Hagen's plan is to hold the magnetic reading head in place by the Bernouilli effect, blowing compressed air from its tip. ...

* * *

WHO'S WHO IN COMPUTERS AND AUTOMATION: SECTION 1 -- PROGRAMMING

(Supplement to first edition, information as of Nov. 3, 1953)

This is a supplement to the first edition of a Who's Who of individuals in the field of computers and automation. The purpose of this Who's Who is to make it easier for all persons interested in this field to get in touch with each other in appropriate ways.

Contents. The following list consists of persons interested in computers or automation, who have reported as a main interest "programming", for whom additional or revised information has been received up to Nov. 3, 1953.

Reporting. If you are interested in any phase of computing machinery, robots, cybernetics, or automation, and if you would like to be included in the Who's Who, please send us: your name (please print), address, organization (and its address), your title, main interests (note list appearing under "Abbreviations" below, and specify any other interests), year of birth, your college or last school, years of experience in the field, your occupation, and any more information about yourself that you may care to furnish. (A blank for your Who's Who entry appears on another page in this issue). Your listing in the Who's Who does not depend in any way on your subscription to COMPUTERS AND AUTOMATION although of course your subscription will be welcome.

Entry. Each entry in the Who's Who when it becomes complete contains: name / title, organization, address / interests / year of birth, college or last school (background), years in field, occupation. The address has been substantially contracted to avoid the nuisance of unwanted mail. In cases where no information has been given (for example, about occupation) a "-" denotes omission.

Abbreviations. Since a great deal of information is to be presented, abbreviations have been extensively used. Nearly all these abbreviations can be easily guessed, like those in a telephone book. The letters A,B,C,D,E,M,P,S stand for main interests "Applications, Business, Construction, Design, Electronics, Mathematics, Programming, Sales", respectively, as provided for in the Who's Who entry blank.

Liability. Although we have tried to make each entry complete and accurate, we assume no liability for any statements expressed or implied.

Corrections. We shall be very grateful for any information, additions, or corrections that any reader is able to send us.

Roster

A: Alway, G G / sci staff, Math Div, Natl Physical Lab, Teddington, Eng / ADMP / '27, Camb Univ, England, 6, -

Angstadt, Lloyd H / mgt consltnt, Dir Educ, Remington Rand, Phila, Pa / ABP / '96, Univ Pa, 10, -

B: Barger, Stewart D / des engr, Tally Register Corp, Seattle, Wash / ACDP / '15, Wash State Col, 2, engr

Baker, Richard H / consltnt, Elecnc Comp Div, Remington Rand, Phila, Pa / ACDEMP / '21, Los Angeles City Col, 12, consltnt compg sys des
Barry, Daniel / -, Actuarial Dept, N Y Life Ins Co, N Y C / ABMP / '09, -, stud acty
Boss, T B / sci staff, Math Div, Natl Physical Lab, Teddington, Eng / ADMP / '05, Oxford Univ, England, 23, -
Bohm, Richard H / statl dir, Allstate Ins Co, Chic, Ill / ABP / '08, Nrthwn Univ, -, -
Bresticker, Claire, Mrs / mathn, Research Studies Sec, Appld Physics Br, Signal Corps Eng Labs, Ft Monmouth, N J / ABCDEMP / '28, NYU(MA), Bklyn Col(BA), 1, mathn
Briney, G S / aplcn engr, Brown Instr Div, Minneapolis-Honeywell Regulator Co, Phila, Pa / ABP, process contr aplcns of compg / '21, Univ Akron, Va Poly Inst, 3, engr
Brown, George W / -, Internl Telemeter Corp, Los Angeles, Calif / ABCDMP / '17, Princeton Univ (PhD'40), 7, mathn
Brown, F Stuart / supt, Procedures Dept, Amer Ins Co, Newark, N J / ABP / '96, -, -

C: Claydon, D O / sci staff, Elecncs Sec, Natl Physical Lab, Teddington, Eng / ADEP / '22, Southall Techl Col, London, 5, -
Clutterham, David R / sr aerophysics engr, Convair, Ft Worth, Tex / ADEP / '22, Univ Ill (PhD, Math), 4, res engr
Codd, Edgar Frank / hd, Operns Res Dept, Computing Devices of Canada, Ottawa / ABDEMP, operns res / '23, Oxford Univ, 4, consltnt
Coughran, E H / apld sci rep, IBM Corp, Los Angeles, Calif / ABEMPS / '28, Pomona Col, 1, mathn
Crumb, Carl B, Jr / asst chf engr, Tally Register Corp, Seattle, Wash / ABDP, analog-digital conversion / '19, Columbia Univ, 4, engr
Cumming, William H / busn ecomst, Social Sec Admn, Balto, Md / ACDP / '07, Iowa State Col (BS, EE'29), 4, -
Curtis, B (Miss) / expermntl stf, Math Div, Natl Physical Lab, Teddington, Eng / MP / '26, London Univ, 5, -

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Dilling, M R / eng vp, Tally Register Corp, Seattle, Wash / ACDEP / '20, Wash State Col (BSEE'41), 12, engr exec
Dixon, Wesley C / -, Compn Sec, U S Naval Prvg Grnd, Dahlgren, Va / MP / '25, Univ Conn (AB), 2, mathn-prgmr

E: Eich, Edward D / -, Anaconda Wire & Cable Co, N Y / AP / -, MIT ('48), engr

F: Friend, Edward H (lt jg) / res mathn, USN, Wash, D C / MP, aplcns to actuarial math & ins prob / '29, Princeton Univ, 2, mathn & actuary

G: Gibbons, James / sr sys speclst, Price Waterhouse Co, N Y C / ABDEP / '16, -, 18, consltnt punched card acctg
Gordon, Barry / mathl analyst, Lockheed Aviation Corp, Burbank, Calif / ADMP / '27, Queens Col, 3, mathn

H: Hague, Merl Thomas / sr salesman, IBM Corp, N Y C / ABEMPS / '26, U Pa, Moore Sch EE, 2, salesman
Haines, Philip H / expermntl stf, Math Div, Natl Physical Lab, Teddington, Eng / AMP/ '05, Oxford Univ, 20, -
Hankam, Eric V / instructor, Watson Sci Comp Lab, NYC / AMP / Columbia Univ, 8, mathn
Hayes, J G / sci stf, Math Div, Natl Physical Lab, Teddington, Eng / AMP / '23, Camb Univ, 9, -
Holzmann, Ernest G / jr engr, Shell Dev Co, Emeryville, Calif / AP / '21, MIT, -, sys engr
Huber, Robert C / employee benefit consltnt, Ostheimer & Co, Phila, Pa / ABCDEMSP / '24, Lehigh Univ, 1, mathn
Huxtable, Myron H / -, -, Sioux Falls, S D / MP / '25, Univ S D, 2, student
Hydeman, W Robert / stf mathn, Engrg Res Assoc, Div of Remington Rand, Arlington, Va/ ABMPS, log des / '13, MIT, 7, mathn

J: Jeanneney, J P / -, -, N Y C / ABP / -, Sorbonne, France, 20, mgt consltnt comp mach
Johnson, William A / rep, Apld Sci Div, IBM, Boston, Mass / ABMP / '24, Bowdoin, Columbia Univ, 5, -
Johnston, Robert F / res engr, Computation Centre, Univ Toronto, Canada / CDEMP / '21, Univ Toronto, 4, engr

K: Kaufman, Sidney / sr physicist, Shell Dev Co, Houston, Tex / CDEMP / '08, Cornell Univ, 5, physicist
Kintner, Paul M / elec sci, BRL, Aberdeen Prvg Grnd, Md / ADEP / '19, Univ Ill, 2, elec sci
Klein, Jerome J / suprvr, Tab Dept, Glemby Co, N Y C / ABMP / -, CCNY, -, statn
Kubie, Elmer C / tech speclst, IBM, Endicott, N Y / ADEMPS / '26, Columbia Univ, 3, -

L: Lappeus, Belford J / tab mgr, Wright Aeronautical, Woodridge, N J / ABEMPS / '12, NYU (BS'34), 20, -
Lida, Sidney L / apld sci rep, IBM, N Y C / ABEMP / -, Univ Kansas, 2, mathn
Loveman, Bernard / assoc proj engr, Proj Cyclone, Reeves Instr Corp, N Y C / DEMP, analog compn & des / '25, NYU, 3, engr

M: Macklin, David / comp engr, Republic Aviation Corp, N Y / ACDEMPS, Boolean algebra/ '18, Columbia Univ, 3, comp engr
Marshall, David W / sr proc analyst, Metropolitan Life Ins Co, N Y C / BP / '20, Harv Bus Sch, 4, mgt engr
Maull, Lewis C / mgr, Mngmt Serv Dept, Arthur Young Co, N Y / ABEP / '14, U Pa, 7, mngmt consltnt

McCourt, Robert / spec rep, Standard Register Co, N Y C / ABEPS, forms & form feeding / -, -, -
Mederos, Thomas S, Jr / sales mgr, Apld Sci Corp of Princeton, N J / ABS, dev & sale specl compnts for comp / '20, Princeton Univ, 5, sales mgr
Michel, J G L / sci stf, Math Div, Natl Physical Lab, Teddington, Eng / ACDEMP / '16, Manchester Univ, 17, -
Michels, Lowell S / res engr, Bendix Comp Div, Los Angeles, Calif / ADMP / '27, Oreg State Col, 2, res engr
Moncreiff, Bruse / princ mathn, Battelle Memorial Inst, Columbus, O / ABDP, des &c for busns data handlg sys / '19, Univ Ill, Harv Univ, 5, mathn
Morrison, C R / -, Comp Res Corp, Calif / ABCDEPS / '18, Ga Sch Tech, 3, engr

N: Neisius, Vincent N / prgmg dir, Logistics Research Inc, Redondo Beach, Calif/ MP/ '17, Ga Inst Tech, 1, mathn
Newman, E A / chf engr, Elecns Sec, Natl Physical Lab, Teddington, Eng / ADEP / '18, London Univ, 5, engr
Nielsen, K L / hd, Math Div, U S Naval Ordnance Plant, Indnpls, Ind / AMP / '14, Univ Ill (Mich & Syracuse), 2, mathn
Norton, H J / sci stf, Math Div, Natl Physical Lab, Teddington, Eng / AMP / '28, Chelsea Polytech, Univ London, 6, -

O: O'Riordan, William P / -, Payroll Audit Div, Metropolitan Life Ins Co, N Y C / ABCDEP / -, -, -, -

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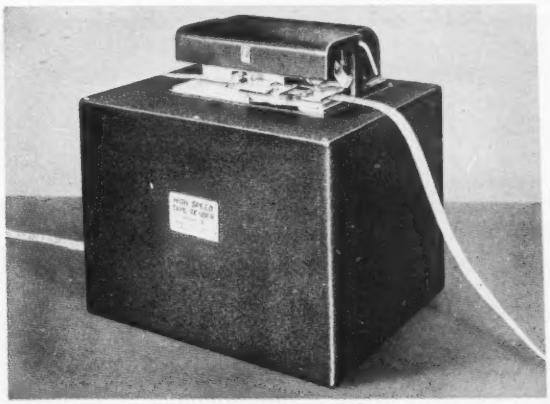

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Pederson, James A / analyst, Dept of Defense, Wash, D C / ABCDP / '29, MacalesterCol, St Paul, Minn ('51), 2, prgmr

R: Reed, Benjamin F, III / engrg draftsman, Long Beach Naval Shipyard, Calif /ACDMP/ '24, Long Beach City Col, 0, draftsman (calculator)
Rich, Kenneth C / -, Naval Ordnance Test Sta, China Lake, Calif / AMP / '17, UCLA, 5, mathn
Rinaldi, Leonard D / mathn, Cornell Aero Labs, Buffalo, N Y / ABMP, automatic compg/ '24, Univ Conn, 5, mathn
Riskin, Bernard N / prgmr, Eckert-Mauchly Div, Remington Rand, Phila, Pa / BPS / '28, Temple Univ, 2, prgmr
Robertson, H H / sci stf, Math Div, Natl Physical Lab, Teddington, Eng / MP / '23, Univ London, 4, -
Rudin, Bernard D / mathl analyst, Marquardt Aircraft Corp, Van Nuys, Calif / ADMP / '27, Calif Inst Tech, Univ So Calif, 2, analyst & prgmr

S: Seely, Oliver D / sr mngt assoc, Metropolitan Life Ins Co, N Y C / ABP / '02,Univ Utah, 4, indus engr
Shannon, Claude E / res mathn, Bell Tel Labs, Murray Hill, N J / CDMP / '16, MIT, 10, mathn
Simonet, William P / tab analyst, Lockheed Aircraft Corp, Burbank, Calif / ABMP, data processing analyzing / '25, UCLA, 1, analyst
Snyder, Samuel S / res analyst, Dept of Defense, Wash, D C / DP / '11, Geo Wash Univ, 6, supvr comp installations
Soden, Walter G / -, NAMTC, Pt Mugu, Calif / MP / '26, Univ So Cal ('51), 2, mathn
Solomon, I / asst to vp, L & C Mayers, N Y C / ABEP, sys & meth / '18, CCNY, 14, -
Solomonoff, Raymond J / engr, Avion Instr Corp, Paramus, N J / ACDEMP / '26, Univ Chic (MS Physics'51), 2, mathn, physicist, engr
Stechert, Dietrich G / res engr, Gates Rubber Co, Denver, Colo / AMP / '18, Univ Colo, -, res engr
Sternlight,David / stf mbr, Compn Lab, Arthur D Little, Inc, Camb, Mass / ADEMP, compnts / '32, MIT (Whirlwind), 1, IBM-CPC comp & mathn
Stover, Henry S, Jr / sr proj engr, Mergenthaler Linotype, Bklyn, N Y / ABPS / '23, Stevens Inst ('49), 3, engr

T: Todd, Richard / sr compns engr, Chance Vought Aircraft, Dallas, Tex / AMP / '23, Bucknell Univ, 2, engr

V: Vickers, T / expermntl stf, Math Div, Natl Physical Lab, Teddington, Eng / AMP / '19, Camb Univ, 12, -

W: Wadel, Louis B / proj aerophysics engr, Chance Vought Aircraft, Dallas, Tex / AD EMP / '27, MIT, 5, engr
Walker, Ernest C (lt) / -, BuShips, Navy Dept, Wash, D C / AP / '14, Geo Wash Univ, 3, problem analyst
Wallace, Frank / partner, Peat Marwick Mitchell Co, N Y C / ABP / '11, Harv Bus Sch, (MBA), 13, mngt controls consltnt
Wilkinson, J H / sci stf, Math Div, Natl Physical Lab, Teddington, Eng / ACDEMP / '19, Trinity Col, Camb Univ, 13, -
Winget, Don, Jr / dev engr, Cincinnati Gilbert Mach Tool Co, O / CDEP, mach tool control / '07, Univ Cincinnati, 27, engr

Wischnia, Herbert F / sr engr, Raytheon Mfg Co, Chic, Ill / DE, servo / '25, Penn State, 6, engr
Wilson, Verne H (lt) / proj engr, WADC, Wright-Patterson AFB, Ohio / ADMP / '30, Univ Mich, 2, mathn & logician
Woodger, M / sci stf, Math Div, Natl Physical Lab, Teddington, Eng / AMP / '23, Univ College, England, 7, -
Woodward, Raymond W / dir, Elecncs Div, Gen Res Lab, Underwood Corp, Hartford, Conn / '93, Trinity, Geo Wash Univ, 20, engr
Woodward, Viola / chf, Ordvac Sec, Computing Lab, BRL, Aberdeen Prvg Grnd, Md / MP / '20, Univ of Cuiti(?), Stanford Univ, 5, mathn
Wulfing, George A / proj engr, Avion Instr Corp, Paramus, N J / EMP / '25, Univ N H, 2, elecnc engr

Y: York, E J / sci stf, Math Div, Natl Physical Lab, Teddington, Eng / AMP / '17, London Univ, 14, -
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PATENTS

by Hans Schroeder, Milwaukee, Wisconsin

The following is a compilation of patents pertaining to computers and associated equipment, taken from the Official Gazette of the United States Patent Office, issued on the dates indicated. Each item consists of: patent number / inventor(s)/ assignee / brief description of the invention.

September 15, 1953: 2,652,194 / C J Hirsch, Douglaston, N Y / Hazeltine Research, Inc, Chicago / Electrical computer for solving equations involving known and unknown parameters

2,652,195 / P T Nickson, East Braintree, Mass / Raytheon Mfg Co, Newton, Mass / Correction device for function generators using bar linkages

2,652,490 / M M Levy, London, England / General Electric Co, Ltd, London, England / Integrating circuit using a triode and a pentode

2,652,554 / F C Williams, Timperley, and J C West, Hindley, England / Natl Research and Development Corp, London, England / Rotating magnetic drum storage system for electronic binary digital computers

September 22, 1953: 2,652,978 / E W Pike, Newton, Mass / Raytheon Mfg Co, Newton, Mass / Multiplication and division linkage operator

2,653,254 / C F Spitzer, Syracuse, N Y , and R J Reich, Hamden, Conn / General Electric Co, N Y / Flip-flop using two saturable, series resonance-tuned transformers as non-linear elements

2,653,285 / J W Gray, Cambridge, Mass / USA, Secy of War / Servo system for controling and comparing shaft rotation velocities

September 29, 1953: 2,653,761 / J A Lawrence and K M Heron, London, England / - / Electromechanical calculating machine for determining the value of a function of several variables

2,654,080 / F A Browne, Jr, Brookline, Mass / Transducer Corp, Boston / Magnetic memory using a multiplicity of magnetic cores

October 6, 1953: No applicable patents

October 13, 1953: 2,655,426 / G W Barnes, Jr, Clifton Hts, Pa / Minneapolis-Honeywell, Minneapolis, Minn / Electric apparatus for recording graph on a chart, plotting one input signal versus another

2,655,607 / A H Reeves, London, England / Internatl Standard Electric Corp, New York/ Electric delay device employing semiconductors

2,655,609 / W Shockley, Madison, N J / Bell Telephone Labs, Inc, New York/ Bistable circuit, using one n-p-n and one p-n-p transistor

2,655,630 / G F Kelk, Leaside, Ont, Can / A V Roe Canada Ltd, Maton, Ont, Can /Electric control for contour milling machine; pressure sensitive device is a variable capacitor changing the frequency of an oscillator

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If you are interested in a listing for your organization, please supply the information for a Roster entry (see p. 10) and write to Edmund C. Berkeley and Associates, Publishers of COMPUTERS AND AUTOMATION, 36 West 11 St., New York 11, N. Y.

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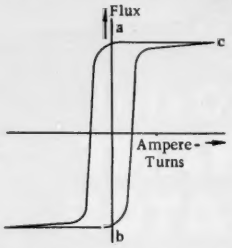

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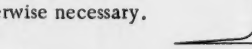

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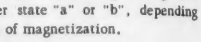

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INDEX

This index covers information published in issues of THE COMPUTING MACHINERY FIELD, vol. 1 no. 4 (Oct. 1952) and vol. 2 no. 1 (Jan. 1953), and COMPUTERS AND AUTOMATION, from vol. 2 no. 2 (Mar. 1953) to vol. 2 no. 8 (Nov., 1953), inclusive. In order not to delay the current issue (Dec., 1953), it has not been included in the index. The last part of each entry in the index gives: volume / number (month of issue), page number.

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Mechanical Translation, by Andrew D. Booth, Birkbeck College, London
Medical Diagnosis, by Marshall Stone, University of Chicago
July: Machine Translation, by Y. Bar-Hillel, Mass. Inst. of Technology
Robot Traffic Policemen, by George A. W. Boehm, Science Editor, Newsweek
How to Talk About Computers, by Rudolf Flesch, Author of "Art of Plain Talk"
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The Meeting of the Association for Computing Machinery in Cambridge, Mass., September, 1953, by E. C. Berkeley
November: Who Will Man the New Digital Computers? by John W. Carr III
Electronic Equipment Applied to Periodic Billing, by E. F. Cooley
Air-Floating: A New Principle in Magnetic Recording of Information, by Glenn E. Hagen

REFERENCE INFORMATION:

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Roster of Organizations Making Components

List of Automatic Computers

Who's Who in the Field of Computers and Automation

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Patents

Price of back copies, $1.25 each -- or a subscription (see rates on page 4) may be specified to begin with any issue from October 1952 to date.

WRITE TO:

Edmund C. Berkeley and Associates
36 West 11 St., New York 11, N.Y.

ADVERTISING IN "COMPUTERS AND AUTOMATION"

Memorandum from Edmund C. Berkeley and Associates
Publishers of COMPUTERS AND AUTOMATION
36 West 11 St., New York 11, N. Y.

1. What is "COMPUTERS AND AUTOMATION"? It is a magazine published monthly, except June and August, containing articles and reference information related to computing machinery, robots, automatic controllers, cybernetics, automation, etc. One important piece of reference information published is the "Roster of Organizations in the Field of Computers and Automation". The basic subscription rate is $4.50 a year in the United States. Single copies are $1.25. The magazine was called THE COMPUTING MACHINERY FIELD until the March, 1953, issue; prior to that issue, it was published less often than ten times a year.

2. Who are the logical readers? The logical readers of COMPUTERS AND AUTOMATION are some 3000 persons who are concerned with the field of computers and automation. Many people are entering this field all the time. These include a great number of people who will make recommendations to their organizations about purchasing computing machinery, similar machinery, and components, and whose decisions may involve very substantial figures. We have been carefully gathering the names and addresses of these people for some time and believe we can reach them. The print order for the December issue was 1400 copies. The paid subscriptions on November 10, 1953 were a little over 950. The overrun is largely held for eventual sale as back copies.

3. What type of advertising does COMPUTERS AND AUTOMATION take? The purpose of the magazine is to be factual and to the point. For this purpose the kind of advertising wanted is the kind that answers questions factually. We recommend for the audience that we reach, that advertising be factual, useful, interesting, understandable, and new from issue to issue. We have had a number of comments expressing satisfaction with our style of advertising.

4. What are the specifications and cost of advertising? COMPUTERS AND AUTOMATION is published on pages 8½" by 11" and produced by photooffset. The closing date for any issue is approximately the 10th of the month preceding. If possible, the company advertising should produce final copy, which should be actual size and assembled, and may include typing, writing, line drawings, printing, screened halftones, etc. -- any copy that may be photoffset without further preparation. If inconvenient to produce this, we will take rough copy and arrange with the printer to prepare it; there will be small additional charges in this event. Display advertising will be sold in units of full pages (ad size 7" by 10", basic rate $130), and half pages (basic rate $70); back cover, $250; inside front and back cover, $160. Classified advertising will be sold by the word (40 cents a word), with a minimum of ten words. The following discounts will apply to display advertising excluding cover space: 20% for a company with less than 50 employees and a publisher of books; 40% for a company of less than 20 employees.

5. Who are our advertisers? Our advertisers in recent issues have included the following companies, among others:

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Ferranti Electric Co.
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The purpose of COMPUTERS AND AUTOMATION is to be factual, useful, and understandable. For this purpose, the kind of advertising we desire to publish is the kind that answers questions, such as, What are your products? What are your services? And for each product, What is it called? What does it do? How well does it work? What are its main specifications? Adjectives that express opinion are not desired. We reserve the right not to accept advertising that does not meet our standards.

Every advertisement in this issue, we believe, is factual and objective. For these reasons, we think that the advertising is likely to be worth reading. So far as we can tell, the statements made are reasonable, informative and worth considering.

Following is the index to advertisements:

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If you wish more information about any of the products or services mentioned in one or more of these advertisements, you may circle the appropriate CA No.'s on the Reader's Inquiry Form (see page 32), and send that form to us -- we pay postage (see the instructions). We shall then forward your inquiries, and you will hear from the advertisers direct.

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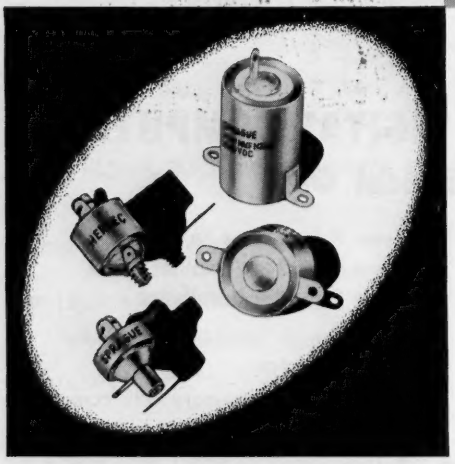

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